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ARE THE COSTS AND BENEFITS OF HEALTH RESEARCH MEASURABLE?

M.B. Wilk

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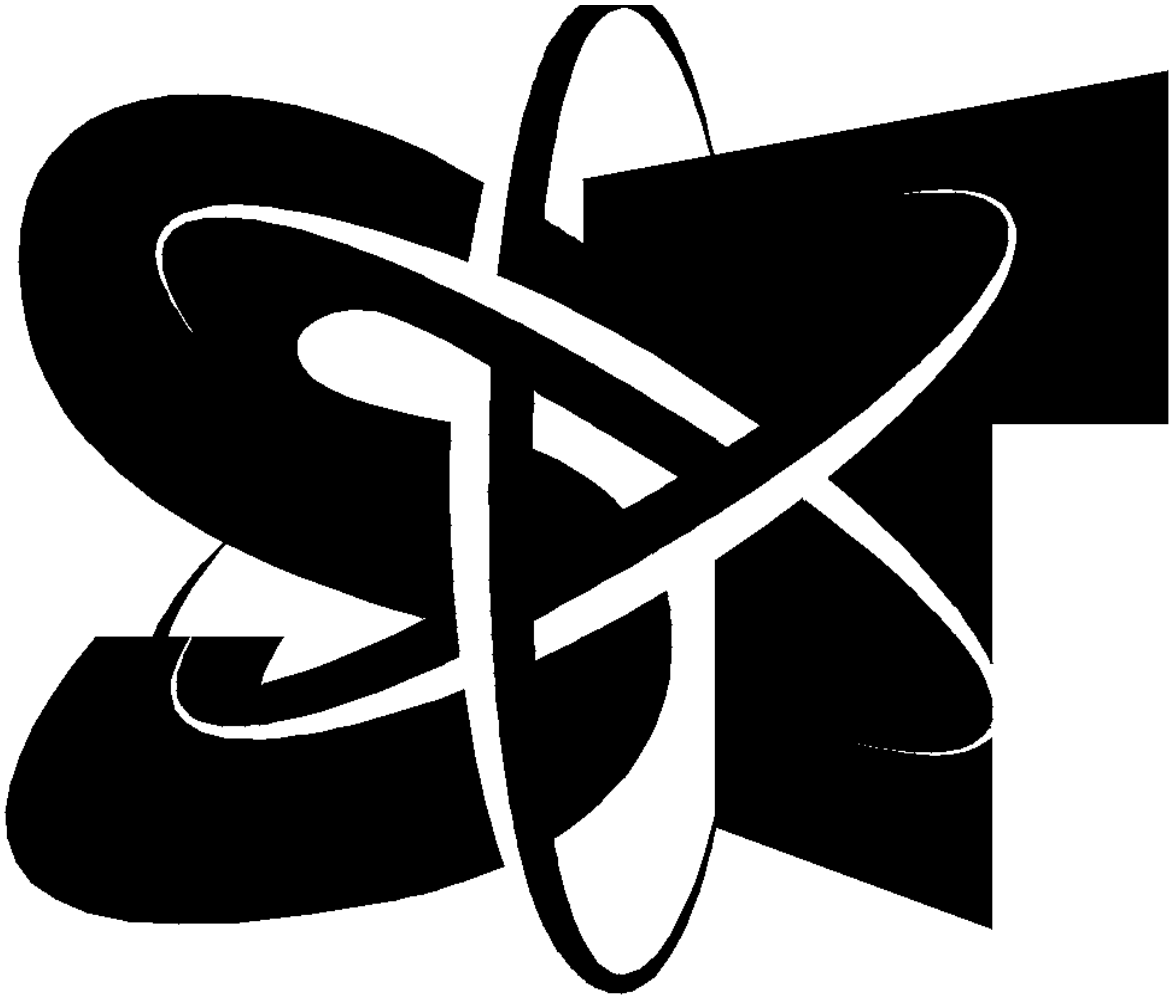

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ARE THE COSTS AND BENEFITS OF HEALTH RESEARCH MEASURABLE?*

M.B. Wilk**

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THE INFORMATION SYSTEM FOR SCIENCE AND TECHNOLOGY PROJECT

The purpose of this project is to develop useful indicators of activity and a framework to tie them together into a coherent picture of science and technology in Canada.

To achieve the purpose, statistical measurements are being developed in five key areas: innovation systems; innovation; government S&T activities; industry; and human resources, including employment and higher education. The work is being done at Statistics Canada, in collaboration with Industry Canada, and with a network of contractors.

Prior to the start of this work, the ongoing measurements of S&T activities were limited to the investment of money and human resources in research and development (R&D). For governments, there were also measures of related scientific activity (RSA) such as surveys and routine testing. These measures presented a limited and potentially misleading picture of science and technology in Canada. More measures were needed to improve the picture.

Innovation makes firms competitive and more work has to be done to understand the characteristics of innovative, and non-innovative firms, especially in the service sector which dominates the Canadian Economy. The capacity to innovate resides in people and measures are being developed of the characteristics of people in those industries which lead science and technology activity. In these same industries, measures are being made of the creation and the loss of jobs as part of understanding the impact of technological change.

The federal government is a principal player in science and technology in which it invests over five billion dollars each year. In the past, it has been possible to say how much the federal government spends and where it spends it. The next report, to be released early in 1997, will begin to show what the S&T money is spent on. As well as offering a basis for a public debate on the priorities of government spending, all of this information will provide a context for reports of individual departments and agencies on performance measures which focus on outcomes at the level of individual projects.

By the final year of the Project in 1998-99, there will be enough information in place to report on the Canadian system on innovation and show the role of the federal government in that system. As well, there will be new measures in place which will provide a more complete and realistic picture of science and technology activity in Canada.

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French version of this document is also available.

1. INTRODUCTION

The purpose of these notes is to consider some of the conceptual and practical issues pertinent to measurements related to “health research”.

1.1 Research Funding Concerns

Concerns regarding research funding are ubiquitous across scientific disciplines, across institutions, across nations and across individual researchers. Motivations for concerns range from parochial interests to sustaining scientific advancement in general. Fiscal realities indicate that research funding has become increasingly competitive both internal to research and in relation to other areas. This has heightened the interest in acquiring objective communicable measurements to help demonstrate socio-economic value and to help guide policy and priorities.

1.2 Role and Limitations of Statistical Measurement

Statistical measurements have major prominence and importance in the functioning of modern society. Their general purpose is to provide information on the conditions and prospects of society. The applications categories of such information include:

- Research to probe relationships, to test theories, to develop models, to update models.
- Monitoring status and trends.
- Providing common data bases for socio-economic - political intercourse, involving policy, planning, program operation, program evaluation, legislation and legal contracts.

Statistical measurement is oriented to production of properties of aggregates - totals, averages, variabilities, distributions. Some outputs are statistical estimates, based on sample data, of aggregate properties which are directly observable in principle, for example the number of babies born in a time period. Many statistical indicators are analytic constructs, more or less complex, which are intended to be representative of some underlying concept. For usefulness of the statistical indicator, it is important that the concept has a consensus acceptability as to its meaningfulness.

The concept may be “understood” as part of a theoretical structure or by consensus convention or as some sort of extrapolation of anecdotal experience. The statistical indicator has its value as an operational realization of the concept.

Currently, there is a notable increase in the ever-present criticisms of (prominent) statistical indicators regarding their adequacy of representation of underlying concepts. Examples of some public and professional perceptions are: that GDP growth does not

adequately represent economic progress; that the CPI is a biased measure of inflation; that official unemployment figures do not fully reflect the "real" rate of unemployment; that trade data don't fully cover services; that census population data need correction for undercounted population categories. There are many different circumstances which can lead to such criticisms. My point of emphasis here is that the formulation and use of statistical indicators is intrinsically involved with the nature of the general understanding of, and the consensus acceptability, of underlying concepts.

Despite its central importance in socio-economic matters, statistical measurement has major limitations, both in practice and in principle. For instance: Canadian statistical indicators currently lag behind the demand for labour; there is little usable information on the output of education, on the outputs of health care services; there is no current detailed data on the occupational distribution of employment; there is no conceptual framework for the socio-economic effects of scientific research. It requires a mighty analytical investment to assess the consequences of NAFTA or of government subsidies of business. This is not to say that such topics are blanketed by total ignorance, but current statistical measurement does not provide definitive insights into the status and mechanisms of human - socio-economic systems. And the various relevant sciences are primitive with respect to the awesome challenges of comprehending or controlling the evolution of those systems.

1.3 Some Personal Axioms

(i) I have an abiding faith in the central importance of scientific research to the advancement of civilization (while recognizing the realities that not all applications of science are uniformly beneficial).

(ii) I regard research pertinent to health as of preeminent importance in human affairs.

(iii) The objective of health research funding should be to support the full range of determinants of health subject to peer judgment of potential research effectiveness.

(iv) Empirical studies are essential complements to research theories, to policy beliefs and to program management.

(v) While (health) research is in the general public interest, specific results may not benefit any particular entity, nor indeed produce any documented socio-economic benefit.

2. CURRENT STATUS OF HEALTH-RELATED MEASUREMENT

The status of health-related measurement is not commensurate with the enormous personal and societal concern with health.

2.1 Data

Vast amounts of data are collected, connected to health. Motivations include:

- research on determinants of health
- financial administration
- treatment testing
- legal, regulatory and professional requirements
- services management
- medications development
- diseases incidence
- birth and death information
- health program experiences
- health services utilization
- monitoring population health status

The array of data-producing instruments include:

- statistical surveys
- administrative records
- targeted research investigations (experimental and observational)
- "anecdotal" reports of pilot programs
- registries (births, deaths, diseases)

While the data bases are plentiful and rich, there are complex impediments to their productive exploitation. These involve: an absence of common standards in concepts and operational definitions; non-compatibility of information systems; lack of adequate quality control; minimal longitudinal person-specific data; difficulties of obtaining connected sets of multivariate data; the constraints of privacy and confidentiality protection; and cultural resistance to record linkage.

These sorts of "practical" difficulties are compounded by the fact that there is no consensus on a unified conceptual information structure to associate health status or health outcomes to health services, to specific biomedical treatments, to biological mechanisms, to genetic factors, to environmental attributes, to socio-economic situations, to lifestyle factors, etc.

There are promising initiatives, national and international. Examples of Canadian contributions include: the determinants of health framework contribution of CIAR's Population Health Research Program; the longitudinal administrative data base development of the Manitoba Centre for Health Policy and Evaluation; the Statistics Canada implementation of longitudinal surveys of health status, of child development, and

of labour and income dynamics; the formation of the Canadian Institute for Health Information; and the cooperation among these and other health science initiatives.

2.2 Current Statistical Indicators

I think it is fair to characterize the present status of health-related statistical measurement as a litany of inadequacy and non-coherence. This is meant as a descriptive assessment relative to "need" and not as a criticism or disparagement of the work of individuals or of institutions. The conceptual challenges are formidable. And, regrettably, policy makers have been too often satisfied to base fundamental decisions on ideology or anecdote.

Statistical data are voluminous. There are many creative and valuable investigative probes. But outputs are fragmented. Concepts underlying estimates (even of costs) are not standardized. Measures of population health status are many; their nature is highly variable (e.g. the units of life expectancy and those of perceived health status); and the collection of available outputs provides very little sense of coherence, either in relation to "costs" or with respect to "benefits".

> And, this assessment applies to health research à fortiori.

Comments on initiatives and requirements to improve this situation are offered later, after some discussion of complexities concerning the scope of health research, of formulating costs and of developing consensus concepts of benefits.

3. THE SCOPE OF HEALTH RESEARCH

Health research is transdisciplinary (and transnational, as is all scientific work). The subtle intricacies of interrelationships is suggested by the following extract from an Ottawa Citizen column of August 10, 1996, on "Religion and Ethics" by Bob Harvey:*

> "Statistics Canada is conducting the last rites for marriage...[and] will stop...counting marriages...As the Catholic Register put it...'what isn't counted simply doesn't count. The folks at Statistics Canada don't want to count marriages because they don't want marriage to be important'...[But]...University of Chicago sociologist Linda Waite...found [those] legally married live longer, use less alcohol and drugs, take fewer risks...and Waite said researchers like her should be promoting marriage as a healthy lifestyle".

3.1 Relevant Scientific Disciplines

There are very few (if any) areas of investigations which can "logically" be excluded from possible relevance to health - perhaps cosmology. Thus, a process to attribute costs and/or benefits to "health research" needs to define an allocation scheme of contribution to

* The assertions and interpretations made in this column have little relationship to Statistics Canada's intentions, policies and motivations.

"health research" from disciplines such as genetics, anthropology, robotics, materials science, informatics, sociology, statistics, nuclear physics, telecommunications, etc. etc.

3.2 Other Activities of Relevance

Furthermore, since very little is well-established regarding outcomes from "standard" biomedical treatment regimes, evaluation of some aspects of clinical practice have health research relevance. Similarly, pilot programs to influence lifestyle or to test socio-economic interventions (such as Head Start) relate to health research. And experiences with socio-economic services (such as unemployment insurance, welfare and employment equity) may also provide health research insights.

Many current health policy and program advocacies are based on beliefs which deserve investigatory substantiation; for example, that devolution of responsibilities for health care services is advantageous to health and/or to costs.

And does the health research umbrella cover the study of work environments, of factors affecting child and spousal abuse, of the value to health of volunteer activities, of social support networks?

3.3 Defining the boundaries

The considerations outlined above are matters of threshold importance to "measurement" and central to the practicalities of data development. The issues require consensus conventions on the appropriateness of concepts. It is hardly satisfactory to have "measurements" labeled as "health research" when the scope of this label is undefined and when the methods of accumulating the data are ad hoc.

Health scientists must bear a primary responsibility for defining the conceptual boundaries within which statisticians are expected to produce "health research" measurements. The further practical challenge to statisticians of developing methodologies to extract the relevant data will also be formidable.

4. MEASUREMENT OF HEALTH RESEARCH COSTS

For the year 1994, the Canadian Institute for Health Information estimates that Canadian expenditures for health research was $798 million. For the same year, the gross expenditures on research and development (GERD) for the health field produced by Statistics Canada was $1519 million.

The former figure has the disclaimer that it excludes R&D costs for goods which are intended for sale. The latter figure carries the comment that " As data are not provided specifically by Health Field, this is Statistics Canada's best estimate". The health research measurement system - even for costs - deserves improvement.

4.1 Allocation of Expenditures

In many areas of statistical data development, one obtains estimates of aggregate properties by compiling data on components of the aggregate. That approach is usually not directly applicable in "cost accounting" because the categories which dictate expenditures usually do not corresponds to the categories for which cost estimates are desired. For instance, in the case of a firm producing several products (and/or services), the identifiable expenditures are for certain "operations" (e.g. wages, supplies, taxes, depreciation, etc.). The production "costs" of interest are for each of the products.

This conundrum is dealt with by establishing conventions for allocating portions of a pool of expenditures to the various products. The number of possible allocation methods is unbounded and the choice is inherently arbitrary - but some methods may seem less arbitrary than others. Consensus convention is essential for any kind of usefulness.

4.2 Cost Allocations to Health Research

For the present case of health research, there are several layers of cost allocation convention required (whether implicit or explicit). In sharp contrast with the cost accounting environment within an institution, the statistician has to cope with "cost accounting" using data from records or judgments of many different institutions. Thus, methods of different universities for allocating costs by departments may vary, as may methods of cost attribution between teaching and research. Additionally, for our current purpose, we would need to allocate some portion of research costs to "health research".

Evidently the aggregation of such estimates across universities, governments, hospitals, private firms and non-profit organizations poses additional perplexities.

4.3 Are the Costs of Health Research Measurable?

Such "costs" are obviously not directly observable (and one might argue they exist only as a figment of economic theory). An acceptable measurement of health research costs involves establishing an analytic construct based on a number of consensus conventions which latter need to be compatible with the statistical practicalities of eliciting data from diverse institutions.

While the resulting estimates are inherently arbitrary, their trend over time may be useful. And there is no escaping the fact that the demand for such costs estimates (of virtually any quality!) is great. At the least, published disparities such as those indicated above deserve attention.

The strong likelihood is that "refinement" of methodologies will lead to a substantial increase in estimates of "health research costs". Depending on the evolution of such refinements for the general field of research and development, the costs attributed to categories such as health research will be non-additive.

5. MEASUREMENT OF HEALTH RESEARCH BENEFITS

There is no stable consensus on how to define "health" operationally. Health has many subjective dimensions and the nature and significance of these must vary over time for each individual and, of course, across individuals. But there are observable attributes from which some measures of health status and of health benefits can be produced.

5.1 Indicators of Population Health Status

There are two broad conceptual categories:

(i) measures based on individual self-perception;

(ii) measures based on non-subjective observation and various combinations of these approaches.

The range of "sophistication" of health status measures is rather substantial. At one end, there are infant mortality rates, general mortality rates, diseases incidence, proportion of low birth weight babies, and direct statistical aggregation of surveys of perceived health status. In the middle are constructs such as longevity, life expectancy and age standardized disease specific mortality rates. At the other end are indicators such as: health-adjusted life expectancy, measures of mental health (e.g. self-esteem and sense of coherence), a health status index (e.g. which combines survey responses on various attributes such as mobility, emotional state and level of pain with survey responses on the ranking of perceived severity of various health conditions).

The multiplicity of health status indicators reflect the multidimensionality of health. There is no unique linear ordering of vectors; and correspondingly there is no unique single indicator of "health status". Of course a publicly accepted dominant health status indicator could emerge, but such consensus has not yet evolved even among health scientists.

5.2 Indicators of Health Research Benefits

One distinction between the measurement of health research benefits and of health status is that the former may be perceived by some (many?) to include economic criteria: for instance, improved cost efficiency in health care services delivery; development of marketable goods, with implications for profits, employment and trade, as well as health status.

In the present climate of political and public obsession with government deficits, with general anxieties about economic development, with tensions regarding unemployment and socio-economic conditions, and concerns about the availability of public funding for education, research and social services (including health care), economic criteria in the measurement of health research benefits may have a high profile.

Evidently, health status indicators of health research benefits are not directly commensurate with economic indicators. Any analytic attempts to develop comparability would involve a variety of convoluted and controversial assumptions (such as a monetary valuation of an average year of life). It is unlikely that such "integrated" analytic constructs would achieve public acceptance or that such measurements would become part of the regular public outputs of a statistical agency.

Indeed, even within the area of economic implications of health research there is potential for tensions among economic benefit indicators: for example, investigations leading to reduction of health care costs may increase unemployment; employment, profits and trade gains from new medications may further accelerate public expenditures on medications, an area which has shown major increases in recent years (without general statistical demonstration of population health status benefits).

5.3 Relating Health Status to Health Research

For many specific health research experimental investigations (e.g. development of a vaccine or of surgical technologies) it may be possible to make a demonstrable connection between the research and identified benefits. Such claims are typically made in health science journals. Systematic compilation of such information is not currently attempted by Statistics Canada or nor is such recognized as a responsibility of statistical agencies.

Statistical measurement can and has contributed to observational health research studies such as the health hazards of smoking and the correlation of socio-economic turmoil with decline in health status in some Eastern European countries.

The importance of research to comprehending the overall system of determinants of health does not necessarily equate to measurement of health status benefits. The investigation of socio-economic influence in population health is undoubtedly of profound importance to health science knowledge. But it would be difficult at this time to measure actual population health status benefit from that research. This may be because of long time lags in health phenomena and/or because of the "stiffness" of behaviour of socio-economic systems. One possible consequence of the research on determinants of population health may be the stimulation and justification of reduced public funding of health care services (which latter may or may not improve health status).

The effects of research-stimulated "interventions" on health may involve long time lags and major confounding from the complexities of life circumstances. Data of detail, quality and relevance is difficult to develop. Activity to measure the association of health status benefits to particular research projects would itself be a challenging area for research.

5.4 Relating Health Benefits to Health Research Costs

Cost-benefit analyses can always be carried out with sufficient imaginative assumptions, however scarce the relevant data. The question is whether such results have integrity or serious utility.

For health-related research and development by a private firm, oriented towards commercial markets, cost-benefit evaluation (with benefits defined in financial terms) may be useful for specific projects and would be measurable over time, by the firm, for the aggregate R&D efforts.

For health research sponsored by governments, hospitals, universities and non-profit institutions, measuring the chain of association between costs of research programs (specific or in aggregate categories) and health status indicators (specific or general) is a laudable ambition which is unlikely of meaningful achievement.

6. CONCLUDING COMMENTS

What follows are some frankly speculative remarks and personal evaluations.

6.1 The current status of health-related statistical measurement is that

- outputs are voluminous
- there are useful ad hoc indicators
- there are a number of creative probes
- there are severe deficiencies in standardization of concepts and of operational definitions
- a consensus coherent framework is lacking.

6.2 There is great potential for advancement without increasing resources by "harmonization" of data development. However, the impediments to coordination among constituencies are formidable.

6.3 Present initiatives in data development (e.g. the longitudinal surveys of Statistics Canada and the systemization of health care administrative data) promise major gains for health science. However, such advances in knowledge do not automatically translate into measurable perceived socio-economic benefits.

6.4 I expect major improvements to emerge from the recently-initiated Statistics Canada project to develop an information system for science and technology. While the intellectual and operational challenges of the project are great, the effort is surely justified by the central influence of science and technology on the evolution of human civilization. The productivity of that project will be strongly affected by the extent of persistent creative collaboration with the science community. The effort will involve "a long twilight struggle"[*].

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[*] President John F. Kennedy's poetic phrase.

6.5 I expect that published estimates of health research expenditures will improve in consistency in the near future. However, the concepts and estimation processes involved may evolve materially with deeper consensus consultations among relevant constituencies. The current attributions of expenditures on health research may be poor lower bounds. But, correspondingly, estimates of the economic impact of health research may increase significantly.

6.6 Statistical indicators of health status are many and "confusing". There is minimal standardization. Health status is multidimensional. I seriously doubt that a "GDP of Health Status" will emerge. The components of health status are, in general, non-commensurate and their relative valuation is highly variable among persons and with changing social and ethical standards over time. But an improvement in the systematization of indicators could contribute to improved public understanding of the determinants of health and of health policy issues.

6.7 I suspect that statistical measurements to demonstrate a meaningful association of health research costs with identified health benefits will either lack integrity or remain an unreal ambition.

6.8 Current statistical measurements for Canada indicate that (very crudely):

- self-perceived unhealthy persons are a minority (about 10%)
- health GERD commands about 13% of total GERD
- health care costs are about 10% of GDP
- health research expenditures may be about 2% of health care costs.

I have little faith in these estimates. Perhaps they serve some useful purpose despite their frailties.

6.9 Currently, there are many beliefs which are influencing health policy, such as:

- the desirability of devolution of responsibilities for health care services,
- that there is "excess capacity" of health care facilities,
- that "current further cuts [in care budgets], in service to deficit reduction, are dangerous to our health"*,

* This quotation is from a media report of a speech by former Health Minister Monique Bégin for whom I have an enormous respect.

- that reduction of expenditures on health care services will be beneficial to economic development,
- that health care costs have increased greatly because of the “aging” of the population,
- that “overutilization” of health care services by Canadians accounts for the high proportion of Canadian health services costs in relation to GDP in international comparisons.

I am not aware of accepted statistical measurements which definitively suggest or demonstrate these beliefs. Needs and opportunities for health-research statistical measurement to contribute to public interest policy issues are many.

List of Research Documents already released

No. 1: The State of Science and Technology Indicators in the OECD Countries, by Benoît Godin, August 1996

No. 2: Knowledge as a Capacity for Action, by Nico Stehr, June 1996

No. 3: Linking Outcomes for Workers to Changes in Workplace Practices: An Experimental Canadian Workplace and Employee Survey, by Garnett Picot and Ted Wannell, June 1996